REMARKS

Claims 1-56 are all the claims pending in the application. Claims 10-27, and 37-54 are withdrawn from consideration.

As a preliminary matter, Applicants thank the Examiner for acknowledging Applicants' claim for foreign priority and receipt of the certified copy of the priority documents.

Applicants request that the Official Draftsperson review the corrected drawings and that a completed Form PTO-948 be included in the next Office Action.

Claims 1-9, and 28-36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Mooradian et al. (U.S. Patent No. 5,461,637) ("Mooradian") in view of Ishikawa et al. (U.S. Patent No. 6,359,919 B1) ("Ishikawa"). Applicants add new claims 55-58 and submit the following arguments to traverse the prior art rejections.

The elected claims 1-9, and 28-36 relate to a laser apparatus using a semiconductor element. The Applicants' invention includes a semiconductor laser element and a surface-emitting semiconductor element. Specifically, the invention includes a semiconductor laser element having a first active layer made of a GaN-based compound which emits a first laser light, and a surface-emitting semiconductor element having a second active layer made of a GaN-based compound which is excited by the first laser light, and then emits a second laser light. In another embodiment, the surface-emitting semiconductor element may comprise a layered structure formed of a plurality of semiconductor layers made of a plurality of GaN-based compounds, and a pair of mirrors are arranged on both sides of the layered structure in the direction of the elevation of the semiconductor layers.

Mooradian relates to an apparatus and method for producing laser radiation from a vertical cavity semiconductor laser. The invention includes an optical pump source and a semiconductor laser. The invention includes a quantum well region formed over a semiconductor substrate. A first reflective surface is formed over the quantum well region, and a second reflective surface is formed over the substrate, opposite the first reflective surface to form a laser cavity. Thermal lasing effect occurs when the quantum well region is optically pumped by the optical pump source.

Ishikawa relates to a gallium nitride-based compound semiconductor laser. In addition to other layers, a p-GaN buried layer and a contact layer through which a current is injected into the opening portion of the current blocking layers and which are larger in area than the opening portion are formed.

In combination with other elements, claim 1 recites a laser apparatus comprising "a surface-emitting semiconductor element having a second active layer made of a GaN-based compound, being excited with said first laser light, and emitting second laser light." In rejecting claim 1, the Examiner states that Mooradian discloses a second active layer made of a GaN-based compound. To the contrary, Mooradian and Ishikawa fail to disclose a second layer made of a GaN-based compound. Mooradian discloses an active region 87 which uses AlGaAs, GaAs, and InGaAs for the quantum wells 88 and barrier layers 94 and 98, not a GaN-based compound (col. 5, line 54 - col. 6, line 2), as in claim 1.

While Ishikawa discloses the use of GaN layers in a semiconductor laser, the GaN layers are used for a laser excited by electrical current, not for a surface-emitting semiconductor

element excited with a first laser light, as recited in claim 1. For example, Ishikawa discloses an n-side electrode 21 and a p-side electrode 22 on the laser (col. 9, lines 47-52), to receive the electrical current. Therefore, there is nothing to indicate that one skilled in the art would combine the references to incorporate the GaN layer disclosed in Ishikawa into the surface-emitting laser disclosed in Mooradian.

To highlight the difference between the Applicants' invention as disclosed in claim 1 and the combination of the cited references, Applicants submit that Mooradian discloses a laser apparatus designed to use the heat generated when the semiconductor material is optically pumped. For example, Mooradian discloses that "[p]ump light absorbed in the semiconductor material generates heat. The heat induces a change in the refractive index of the semiconductor material, causing a thermally-induced lensing effect in the laser cavity . . . " (col. 3, lines 4-8). In the current application, Applicants have noted that the thermal lens effect is not caused in the GaN-based semiconductor elements since the thermal conductivities of GaN-based compound semiconductor elements are very large (approximately 130 W/m*K), compared to the thermal conductivities of the GaAs-based compound semiconductors (approximately 45.8 W/m*K) (page 6, lines 2-13). Therefore, the different performance characteristics of GaN-based compounds and GaAs-based compounds and the inevitable differences in design further shows that one of ordinary skill in the art would not have been motivated to select Mooradian and Ishikawa and to combine them to render the invention as recited in claim 1, obvious.

Claims 2-9, which depend from claim 1, are believed to be patentable for at least the reasons discussed above for claim 1.

Similarly, claim 28 is believed to be patentable because the surface-emitting semiconductor element having a second active layer made of a GaN-based compound as recited in a combination with other elements of claim 28 is not taught by the combination of Mooradian and Ishikawa, nor is obvious to one skilled in the art. Claims 29-36 are believed to be patentable based on their dependency.

Because generic claims 1-9 and 28-36 are allowable, the remaining claims should be rejoined in the application and allowed in the present application.

New claims 55-58 are added without introducing new matter.

Claims 57 and 58 are believed to be patentable because nowhere in Mooradian or Ishikawa is there any teaching or suggestion of a GaN-based substrate in a surface-emitting semiconductor element, as recited in the claims. Applicants submit that the GaN substrate is one of the points of novelty in the invention which provides advantageous effects in a laser apparatus employing a surface-emitting semiconductor element. Since GaN has high thermal conductivity, a substrate made of such material can easily dissipate the heat generated in a surface-emitting semiconductor element. As discussed above, beam deformation due to the thermal lens effect or the light thus becomes very small. Since the excitation laser light is supplied to the surface-emitting semiconductor element through the substrate as recited in claims 57 and 58, the superposition of the oscillation mode and the excitation mode can be carried out well to obtain a good laser beam without deformation.

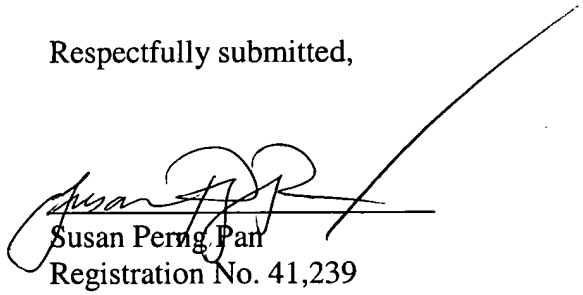
Due to the surface-emitting semiconductor element, the laser apparatus can oscillate with high output power and without deterioration. Since the generated heat can be easily dissipated

by using a GaN substrate, a high output beam without deformation can be obtained. Further, since heat generation at the active layer can be suppressed, lifetime of the laser apparatus can be made long.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 55-58 are added as new claims.